

What is claimed is:

1. A field effect transistor, comprising:

a semi-insulating semiconductor substrate;

a semiconductor layer structure provided on the semiconductor substrate, said semiconductor layer structure including a non-doped first compound semiconductor layer, an n-type second compound semiconductor layer having an impurity doping density ranging from $1 \times 10^{17} \text{cm}^{-3}$ to $1 \times 10^{18} \text{cm}^{-3}$ and a layer thickness ranging from 1nm to 10nm and having an energy level at a lower end of a conduction band thereof, which is less than or equal to an energy level at a lower end of a conduction band of the first compound semiconductor layer, and an n-type third compound semiconductor layer having an energy level at a lower end of a conduction band thereof, which is less than the energy level at the lower end of the conduction band of the second compound semiconductor layer, said non-doped first compound semiconductor layer, said n-type second compound semiconductor layer and said n-type third compound semiconductor layer being sequentially disposed on the semiconductor substrate from the semiconductor substrate side; and

a gate electrode disposed on the semiconductor layer structure, and a source electrode and a drain electrode, said source electrode and said drain electrode being opposite to each other with the gate electrode interposed therebetween and being disposed over the semiconductor layer structure.

2. The field effect transistor according to claim 1, wherein the first compound semiconductor layer is formed of AlGaAs, the second compound semiconductor layer is formed of AlGaAs, and the third compound semiconductor layer is formed of GaAs.

3. The field effect transistor according to claim 1,

wherein said semiconductor layer structure further comprises a fourth compound semiconductor layer having an energy level at a lower end of a conduction band thereof, which exceeds the energy level at the lower end of the conduction band of the third compound semiconductor layer, on the third compound semiconductor layer.

4. The field effect transistor according to claim 3, wherein the fourth compound semiconductor layer is formed of AlGaAs.